AWARD-WINNING JUNIOR RESEARCHER: PLANT SPECIALIST DR. STEVEN SPOEL

Decoding the immune system

The Bayer Science & Education Foundation promotes top research and junior talents. Molecular biologist Dr. Steven Spoel won the 2013 Early Excellence in Science Award for his research into the genetic regulation of the plant immune system. His work on plants may even be transferable to cancer research.

Understanding plants – healing people: biologist Dr. Steven Spoel studies how the immune system functions on a cellular level and how it can be influenced.

Many important discoveries in the life sciences are first made on plants and later applied to humans, which may also be the case with the work of Dr. Steven Spoel. The 34-year-old Dutchman is currently a Royal Society University Research Fellow at the University of Edinburgh's Institute of Molecular Plant Sciences. Spoel has specialized in the immune system of plants or, more accurately, one puzzle piece of it, because the plant defense system is a complex structure of regulator genes. "I'm interested in how plant cells detect and respond to environmental changes," Spoel says. His work centers on plant responses to pathogen infestation. Whether a plant grows and survives depends on numerous factors. In addition to natural enemies, such as insects and bacteria, growth is influenced by the nutrient and water supply, and by high and low temperatures.

Researchers are rapidly learning more about the interplay between the environment and the plant immune system, and in the process expanding their options for arming plants against adverse conditions. "This is a very critical goal if we want to feed the growing global population. Furthermore, the importance of utilizing plants as a source of energy or as drug producers is likewise on the rise," Spoel explains. In addition to making plants more resistant and crop yields more stable, Spoel hopes his research will have another effect: "On a cellular

Early Excellence in Science Award

First established in 2009, the international Bayer Early Excellence in Science Award recognizes talented young scientists in the early stages of their academic careers. An independent expert jury selects three prizewinners in the categories Biology, Chemistry and Materials. Criteria include the originality of the research, as well as the quality and significance of the results. The awards are worth EUR 10,000 each. The other awards in 2013 went to the chemist Dr. Abigail Doyle of Princeton University and Dr. Javier Fernandez of Harvard University in Boston. Doyle developed a method for the low-impact and efficient incorporation of fluorine in organic molecules. In the future, this will make it possible to synthesize substances with unique, previously unknown properties. Fernandez discovered a new material called "shrilk." It displays strength and toughness similar to that of aluminum, but weighs only half as much, is biodegradable, suitable for complex molding processes and can be produced at low cost. The material has potential for use in numerous applications, including packaging and medicine.

level, there are several similarities between the plant and human immune systems. Our research may also uncover possibilities for new cancer treatments." In recognition of his work, Spoel won the 2013 Early Excellence in Science Award, funded by the Bayer Science & Education Foundation. The puzzle piece he concentrates on in his research is salicylic acid. This starting component for acetylsalicylic acid, the active ingredient in Aspirin™, is part of a plant's system of defense against harmful organisms.

Help against pathogens: salicylic acid induces gene expression and activates the immune system

"We know that the plant immune system can switch on specific gene groups to fight pathogens," Spoel explains. Salicylic acid helps it correctly transcribe information in the DNA and switch on the genes required for defense. "Many of these molecular mechanisms in which salicylic acid alters genes exist in the cells of both man and animals," he continues. Errors in this sensitive network have an impact on the metabolism of the entire organism, potentially leading to faulty immune system reactions and the development of disease. "We need to understand in greater detail what effect salicylic acid and other factors have on the finely balanced regulation system, and how we can influence these effects," Spoel says.

Spoel became fascinated with the immune system activator while working on his dissertation at Duke University in North Carolina, USA. He had previously completed his undergraduate studies at Utrecht University in the Netherlands. Spoel knew at a young age that he wanted to dedicate his career to plants. His parents gave him and his siblings a corner of the yard to plant seeds and to water, fertilize and observe the growing plants. "Within a short time, I had taken over my siblings' plots," Spoel remembers. To compensate for all the hard work, the biologist likes to practice judo, a sport he has been involved in since he was five. Spoel also participates every year in the Glasgow half marathon. This stamina and perseverance could very well reward him with a promising career – and new discoveries in cancer research as well.

Veterinarian in Namibia

The 25-year-old veterinarian Marion Leiberich is a fan of Africa. While in college, she used her Carl Duisberg scholarship from the Bayer Foundation to fund an internship at the Windhoek Veterinary Clinic in Namibia.

Practical experience: Marion Leiberich in the operating room

What draws you time and time again to Africa?

Ever since we took a family vacation there, I have been fascinated by the landscape and animal world of Africa. Between high school graduation and college, I spent nine months working for a chimpanzee protection project, observing lions for a research project and volunteering for whale and dolphin research. I also spent all my semester breaks in Africa.

How did you benefit from the internship?

I examined and x-rayed animals, and assisted with ultrasound examinations. I was even allowed to operate. If I can add to this experience by working with wild animals, then hopefully I can be accepted into the Wild Animal Health program in London.

Photos: Bayer AG (1), private (2), Dirk Hansen/Bayer AG (1), Markus Müller-Saran (1)

Chemist in training at the Bayer laboratory

After earning his master's degree in chemistry, Sebastian Keess spent five months in Chemical Development at Bayer HealthCare. We spoke with the 25-year-old Bayer "Deutschland" scholarship-winner about his experience.

Industrial experience: Bayer scholarship-winner Sebastian Keess (center) talks with Thimo V. Schmitt-Lord (left) and laboratory head Dr. Daniel Götz (right) about his work in Global Drug Discovery at Bayer HealthCare in Wuppertal.

What fascinates you about chemistry?

First and foremost the possibility of transforming molecules into substances with entirely different properties, and thereby helping to solve some of the greatest challenges of our age.

What were your responsibilities working as an intern at Bayer HealthCare?

I worked for Global Drug Discovery on the chemical and pharmaceutical development of new drugs. My main job was to study efficient chemical synthesis processes for potential active substances and to optimize their production sequences.

How did you benefit from the scholarship?

I used the money at the university primarily to buy chemicals. The experience I gained from application-oriented research at Bayer opened up entirely new prospects for me: my experiences in the lab will definitely help me make decisions about my future career.

But first I would like to earn my PhD the classical way, at the Berlin University of Technology, and then go abroad for a while. After that it will be time to decide between a career in industry or academia.

Commitment to Nepal

Since receiving her bachelor's degree, physical therapist Alexandra Hummel has been living for her career. With the help of a Hermann Strenger scholarship, she financed an internship at a clinic in Nepal. "Physical therapy is virtually non-existent in Nepal," she relates. She was attracted to Nepal by "the high mountains and because you encounter medical cases there that you normally do not see in Europe." After volunteering and going for her master's degree in physical therapy, Hummel says she would like to work in clinical research: "Using efficacy studies, we can determine which treatments really help." Health insurance companies frequently request this kind of scientific evidence.

Volunteer work: at the Nepal Clinic in Chitwan National Park, Alexandra Hummel applies kinesio tape to a Nepalese patient with arthritis of the knee.

How to apply

The Bayer Science & Education Foundation's tailored scholarship programs support young talents in Germany and abroad, helping them to reach special academic and career goals. All young people from Germany who are planning a study or vocational training project abroad, or foreigners planning similar projects in Germany, are invited to apply. The foundation also offers "Deutschland" scholarships for college students. Applicants should have two things above all: pioneering spirit and a unique project idea which the Bayer Foundation can help to implement as a partner. For more information on the application process, call +49 (0)214/304 11 11, visit the internet site at www.bayer-foundations.com or send an e-mail to: scholarships@bayer-stiftungen.de

INNOVATIONS AT THE INTERFACE BETWEEN BUSINESS, SCIENCE AND HEALTH

Doctor's office interpreters

The Bayer Cares Foundation supports social innovation, for example at the interface between patients and the health care sector. A student initiative called "What have I got?" won the Audience Prize in the 2014 Aspirin Social Award and placed second overall. It is a free service that translates medical terms into comprehensible, everyday language.

The results are sobering: according to studies, most patients have forgotten 80 percent of what their doctor said by the time they leave the office. Since January 2011, a group of dedicated young doctors headed by Anja and Johannes Bittner and Ansgar Jonietz has been working to resolve this situation: At their online portal www.washabich.de, patients can enter their medical results in text form, upload a file or send a fax. A few days later they receive a text that a layperson can better understand – protected by password, discrete and free of charge. "What have I got?" is funded mainly by donations, sponsors and financial awards like the Aspirin Social Award's Audience Prize. "The prize money helps us to translate medical terminology into standard German," explains Anja Bittner.

A patient with shoulder pain, for example, who undergoes an MRI and gets a diagnosis that reads "cortical depression of the humeral head," learns that the hard, outer layer of bone (referred to medically as the cortical bone) on the top of his upper arm bone (the head of the humerus) – is indented. Furthermore, he receives a clear explanation of what an MRI is capable of visualizing, how the shoulder joint is structured and a diagram of aspects relevant to his case. "A complete translation takes about five hours," Bittner says. A thousand physicians are now involved in the program, of whom about 200 actively participate in the translation work. All of them were first trained in how to communicate more effectively with the lay population, something that benefits their everyday work with their own patients as well.

But "What have I got?" is not the only initiative that aims to benefit patients through new social programs. First place in the Aspirin Social Award went to the mobile telephone app "Explain TB." This free service from the Borstel Research Center teaches patients and their families about their disease. Tuberculosis is a life-threatening disease of the poor that infects half a million people every year in Europe alone, including many children and the illiterate. Half of all TB patients in Germany come from countries outside Europe. The "Discovering Hands" initiative is dedicated to another disease: blind and visually impaired people are taught how to physically detect breast cancer for the purpose of early diagnosis and trained to be physical examiners. This innovative concept aims to help break down prejudices against people with physical disabilities and promote respect for their superior sense of touch.

Patient translators: Junior physicians Anja Bittner, Ansgar Jonietz and Johannes Bittner (from left) translate medical diagnoses into more understandable language for laypeople. About a thousand physicians already participate in the online portal at www.washabich.de.

Employee volunteering

The Bayer Cares Foundation is also active in human resources development: "Three Bayer employees will each fly to different continents for three months in 2014 to participate in social projects and look for new answers to unsolved problems," says Thimo Valentin Schmitt-Lord, Chairman of the Bayer Foundations. Their destinations are in developing countries where there is a demand for health education and medical care. For example, Bayer is launching a project in the Philippines to rebuild the country's destroyed health care infrastructure, and a Bayer Business Consulting employee will be there to provide assistance locally.

www.bayer-foundations.com
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